USN | | | | | | | | | | |

10AE65

Sixth Semester B.E. Degree Examination, June/July 2016
Theory of Vibrations

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define the term vibration, explain the types of vibration. **(10 Marks)**

b. Find the Fourier series for the saw-tooth curves as shown in Fig.Q.1(b). **(10 Marks)**

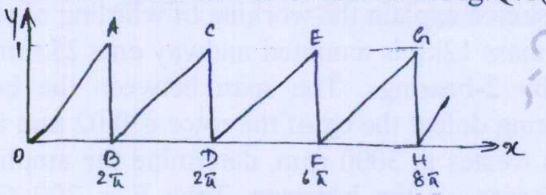

Fig.Q.1(b)

2 a. Determine the natural frequency of a compound pendulum. **(10 Marks)**

b. Determine the natural frequency of two masses m_1 and m_2 connected to the light stiff rod as shown in Fig.Q.2(b). **(10 Marks)**

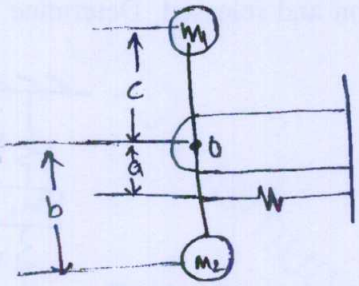

Fig.Q.2(b)

3 a. A machine of mass 20kg is mounted on spring and dash pot as shown in Fig.Q.3(a). The total spring stiffness is 10N/mm and the total damping is 0.15 N/m m/sec. If the system is initially at rest and a velocity of 100 mm/s is imparted to the mass, then determine:

i) Displacement and velocity of mass as a function of time.

ii) Displacement and velocity at time equal to one second. **(10 Marks)**

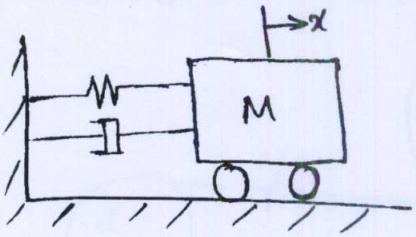

Fig.Q.3(a)

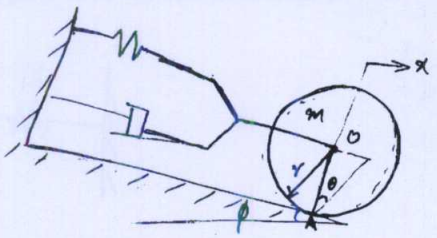

Fig.Q.3(b)

b. Obtain the differential equation governing the motion of the one degree of freedom system shown in Fig.Q.3(b). Also determine the undamped natural frequency of the system. **(10 Marks)**

4 a. Obtain the complete response equation for the motion of a spring mass damper system subjected to a harmonic force F_o sinwt. **(10 Marks)**

b. A mass of 100kg been mounted on a spring dashpot system having spring stiffness of 19,600 N/m and damping coefficient of 100N-sec/m. The mass is acted upon by a harmonic force of 39 N at the undamped natural frequency of the system. Determine:

i) Amplitude of vibration of the mass.

ii) Phase difference between force and displacement.

iii) Force transmissibility ratio.

Given: M = 100kg; K = 19,600 N/m; C = 100 N-sec/m; F_o = 39 N. **(10 Marks)**

PART – B

5 a. With neat sketch explain the working of whirling of shafts without air damping. **(10 Marks)**

b. A rotor of mass 12kg is mounted midway on a 25 mm diameter horizontal shaft supported at the ends by 2-bearings. The span between the bearings is 900mm. Because of some manufacturing defect the cg of the rotor is 0.02 mm away from geometric centre of rotor. If the system rotates at 3000 rpm, determine the amplitude of steady state vibrations and the dynamic forces on the bearings. Take E = 200 GPa. Given: m = 12kg; d = 25 mm; L = 900 mm; e = 0.02 mm and N = 3000 rpm. **(10 Marks)**

6 a. Figure Q.6(1) shows a spring mass system. If the mass m_1 is displaced 20 mm from its static equilibrium position and released. Determine the resulting displacements $x_1(t)$ and $x_2(t)$ of the masses. **(10 Marks)**

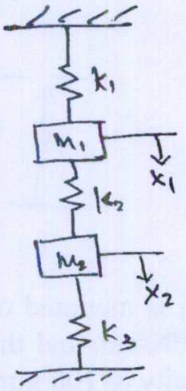

Fig.Q.6(1)

b. Determine the natural frequency of the system shown in Fig.Q.6(b). **(10 Marks)**

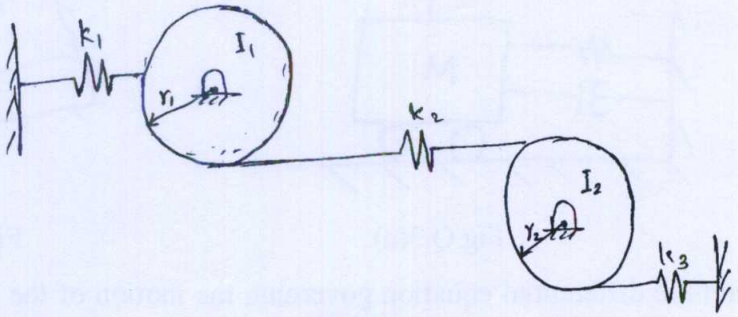

Fig.Q.6(b)

7 a. Derive expressions for amplitudes of vibrations of the two masses shown in Fig.Q.7(a). **(10 Marks)**

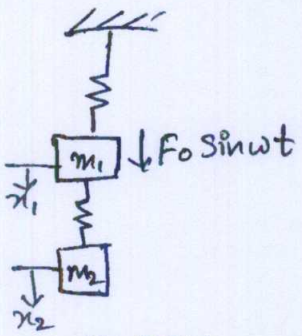

Fig.Q.7(a)

b. A torsional three rotor system is shown in Fig.Q.7(b). Determine i) Differential equation of motion; ii) Frequency equation. **(10 Marks)**

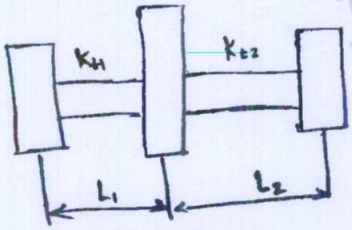

Fig.Q.7(b)

8 a. Explain Dunkerley's method. **(08 Marks)**

b. A shaft of 50 mm diameter and 3 m long is supported at the ends and carries three weights of 1000N, 1500N and 750N at 1m, 2m and 2.5m form the left support. Taking E = 200 GPa, find the frequency of transverse vibrations. **(12 Marks)**

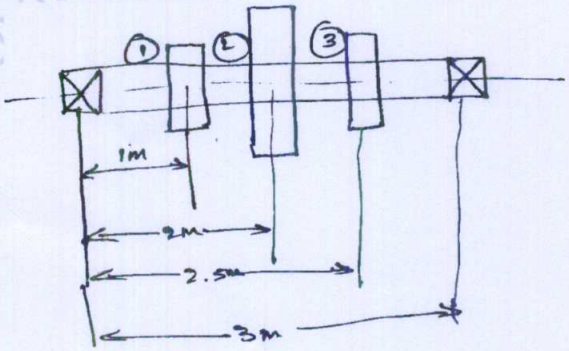

Fig.Q.8(b)

* * * * *